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AN ANALYSIS OF THE ECONOMIC FUNCTIONS IN THE FOUR STUDY COMMUNITIES IN 1982

Report No. 7-84

DIAND NORMAN WELLS MONITORING REPORT SERIES

Prepared for:

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PREFACE

The Norman Wells Oilfield Expansion and Pipeline Project is the first major hydrocarbon development in the North. As such, it offers unique opportunities to observe at first hand the effects of a development project on the environment, the economy and the social fabric of the region. There have been a number of extensive public review processes dealing with major development project proposals, e.g., the Berger Inquiry, and the Environmental Assessment Review Panel (EARP) on the Norman Wells Project itself, which have debated extensively the possible effects of such projects. There have, however, been relatively few opportunities to observe the effects at the time the project is in the construction phase, the time of most likely disruption in a region.

Accordingly, the Department of Indian Affairs and Northern Development mounted a monitoring program with the objective of identifying the impacts, negative and positive, of the Norman Wells Project as development proceeded. The four Mackenzie Valley communities closest to the project are Norman Wells itself, Fort Norman, Fort Simpson and Wrigley. Against the background of a database survey carried out in 1982 intended to provide the picture "before" the start of major construction, the DIAND Norman Wells Socio-Economic Impact Monitoring Program has developed a comprehensive battery of data on certain selected economic and social factors through the conduct of annual field surveys.

This program is, we believe, the first impact monitoring program of its kind, covering as it does the community situations "before", "during" and "after" project construction. The program is under the direction of Professor R.M. Bone of the University of Saskatchewan. Results are being presented in a series of technical reports pertaining to each year for which the survey has been carried out. The present report is designed to provide a comprehensive picture of the program findings from 1982 through 1984. A full list of published reports is presented in the Bibliography.

John Hucker
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1. INTRODUCTION

The purpose of this study is to investigate the economic functions of each of the four communities in the central Mackenzie Valley region of the Northwest Territories. The term "economic functions" refers to the goods and services available from local sources in each community. The research centres on a case study of the following communities: Norman Wells, Fort Norman, Wrigley, and Fort Simpson and is based primarily on data provided by the Norman Wells socio-economic monitoring project being undertaken by the Northern Program, Department of Geography, University of Saskatchewan.

More specifically, the goals of this study are to measure the functional complexity of the communities and to explore the spatial relationships between these centres. The research is therefore broken into three major components:

1. Outlining the historical development of the local economies.
2. Measuring the functionality of the four communities and to explore their hierarchical relationships through the use of a functional index.
3. Exploring the spatial relationships or functional linkages between the centres by detailing the flow of goods and services and also through examining shopping expenditure patterns.

2. HISTORICAL DEVELOPMENT OF THE LOCAL ECONOMIES

This section of the paper deals with establishing the context of the local economies in the four study communities.

2.1 Norman Wells

The establishment of Norman Wells was based on the development of an oil reserve. In 1914 claims were staked at Norman Wells. Drilling activity followed in 1919 and a small refinery was established in the early 1920s. The refinery served a small local demand only. The demand for oil in the region grew in the late 1930s which led to increased drilling activity and the installation of a new refinery. There was a drastic increase in activity in 1944 due to the Canol pipeline. However this military need for Norman Wells oil was short lived. Since the 1970s, expansion has since been driven by the increase in oil exploration in the region. More recently the economic base has diversified to include transportation, expediting, construction, mining and government functions. It also serves as a distribution centre for the surrounding region (Resource Management Consultants, 1983).

2.2 Fort Norman

Fort Norman was established in the late 18th century as a strategic transportation centre. It was the base for exploring the river system. A trading post was established in 1810. Its importance

as a trade centre declined in the 1930s with the decline in the fur trade. During the 1940s and 1950s health care and social assistance services were located in Fort Norman. The provision of a school soon followed. The area residents were attracted by these amenities and they were encouraged to relocate in Fort Norman (Resource Management Consultants, 1983). As a result, by the mid-1960s all the area residents had relocated to town.

2.3 Wrigley

Wrigley was established as a trading post in 1870 due to its strategic location at the confluence of the Willowlake River and the Mackenzie River. This trading post closed in 1921. However, in 1870 the Hudsons Bay Company established a trading post. During the 1940s and 1950s health care and educational facilities were provided in Wrigley. As in Fort Norman a centralization of the local residents followed (Resource Management Consultants, 1983).

2.4 Fort Simpson

Fort Simpson is the oldest established trading post in the Northwest Territories. A fort was built in 1804 due to its location at the junction of the Liard and Mackenzie Rivers. During the 1950s it served as the Mackenzie district transport headquarters. In the 1960s it served as a base for oil exploration activities (Resource Management Consultants, 1983). Fort Simpson was the recipient of a lot of investment by the government. There is a hospital, a boarding school,

RCMP headquarters and headquarters for the territorial government service. It was intended that Fort Simpson would be the regional centre with respect to the provision of government services.

In conclusion, with the exception of Norman Wells the determinant for the development of the local economy was one of strategic location related to river transport and fur trade. With the decline of both the fur trade and the importance of river transport these settlements fell into decline until the 1950s when they were revived through government intervention both to provide health, education and social services and to encourage urbanization. The administrative function was therefore imposed over an existing settlement pattern which was itself determined by historical factors. Norman Wells was located according to its strategic advantage with respect to petroleum reserves. It will be indicated later in this study that the administrative function is not as dominant in Norman Wells as it is in the other three centres.

3. FUNCTIONALITY OF STUDY COMMUNITIES

In this section of the paper the functionality of the four centres will be measured and functional indexes will be calculated in order to determine if a hierarchy exists among these centres with respect to the provision of goods and services.

This section utilizes data that was collected in 1982 in conjunction with the socio-economic impact monitoring of the Norman Wells pipeline project. The business survey included an inventory of all businesses, private and government, operating in the study communities. This data provides the basis for the following analysis.

The first step was to use the Statistics Canada Standard Industrial Classification (S.I.C.) to group the businesses recorded on the survey into functional units. The results are presented in Table 2 through 5. Based on this inventory an index of centrality, or functional index, is calculated.

The functional index is calculated in the following manner. Functions are weighted according to their frequency of occurrence in all of the communities. A point score is allocated to each category based on frequency of occurrence of that type of function in the whole region relative to all other types of functions.

$$\text{Score for Single Function of Type X} = \frac{\text{All Functions in Region}}{\text{All Functions of Type X}}$$

The function scores are summarized in Table 1. X is then

Table 1

Functional Index Calculations

S.I.C.	Function Score
3	58.30
4	175.00
7	175.00
9	43.75
25	175.00
40	9.21
41	87.50
42	35.00
45	5.30
48	43.75
49	43.75
51	175.00
52	175.00
60	43.75
62	87.50
63	58.30
64	58.30
65	35.00
70	87.50
75	87.50
77	35.00
81	15.90
82	15.90
83	13.46
85	35.00
86	21.87
91	58.30
92	58.30
96	175.00
97	175.00
98	43.75
99	17.50

Table 2

Functionality, Fort Simpson, 1982

S.I.C.	# of Firms	Description	Weighted Score
3	2	Fishing and Trapping	116.60
25	1	Wood Industries	175.00
40	8	Building Contracting	73.68
42	3	Trade Contracting	105.00
45	17	Transportation	90.10
48	2	Communications	87.50
49	1	Utility	42.75
51	1	Petroleum Wholesale	175.00
60	2	Food/Beverage Store	87.50
62	1	Household Furniture	87.50
63	1	Auto Parts Sales Service	58.30
64	1	General Retail	58.30
65	3	Other Retail	105.00
70	1	Bank	87.50
75	1	Real Estate Sales	87.50
77	3	Business Service	105.00
81	6	Federal Government	95.40
82	6	Territorial Government	95.40
83	3	Local Government	26.92
85	2	Education	70.00
86	4	Health Social Services	87.48
92	3	Food Beverage Service	174.90
91	1	Accommodation	58.30
96	1	Amusement Recreation	175.00
97	1	Personal Household Service	175.00
98	3	Membership Organization	131.25
99	9	Other Service	157.50

Functional Index: 2790.38

Population: 984

Table 3

Functionality, Norman Wells, 1982

S.I.C.	# of Firms	Description	Weighted Score
4	1	Logging	175.00
7	1	Petroleum Crude	175.00
9	4	Mineral Service	175.00
40	9	Building Contracting	82.89
41	2	Heavy Construction	175.00
42	2	Trade Contracting	70.00
45	12	Transportation	63.60
48	1	Communications	43.75
49	1	Utility	43.75
52	1	Food Beverage Wholesale	175.00
60	2	Food Beverage Retail	87.50
62	1	Furniture Retail	87.50
63	1	Auto Parts Sales Service	58.30
65	2	Other Retail Stores	70.00
70	1	Bank	87.50
77	2	Business Service	70.00
81	2	Federal Government	31.80
82	3	Territorial Government	47.70
85	1	Education	35.00
86	1	Health Social Service	21.87
83	4	Local Government	53.84
91	1	Accommodation	58.30
99	1	Other Service	17.50

Functional Index: 1905.80

Population: 482

Table 4

Functionality, Fort Norman, 1982

S.I.C.	# of Firms	Description	Weighted Score
3	1	Fishing and Trapping	58.30
40	2	Building Contracting	18.42
45	3	Transportation	15.90
48	1	Communications	43.75
49	1	Utility	43.75
64	1	General Retail	58.30
75	1	Real Estate Sales	87.50
81	2	Federal Government	31.80
82	2	Territorial Government	31.80
83	4	Local Government	53.84
85	1	Education	35.00
86	2	Health Social Services	43.74
91	1	Accommodation	58.30
98	1	Membership Organization	43.75

Functional Index: 624.15

Population: 274

Table 5

Functionality, Wrigley, 1982

S.I.C.	# of Firms	Description	Weighted Score
45	1	Transportation	5.30
49	1	Utility	43.75
63	1	Auto Parts Sales Services	58.30
64	1	General Retail	58.30
81	1	Federal Government	15.90
83	2	Local Government	13.46
85	1	Education	35.00
86	1	Health Social Services	21.87
3	1	Fishing and Trapping	58.30

Functional Index: 310.18

Population: 146

multiplied by the number of functions of type X in a particular centre which yields W or a weighted score. The score for each function in each town is calculated. These weighted scores are contained in Table 2 through 5. The sum of the scores of all the different functions in each centre equals the functional index (Davies, 1967).

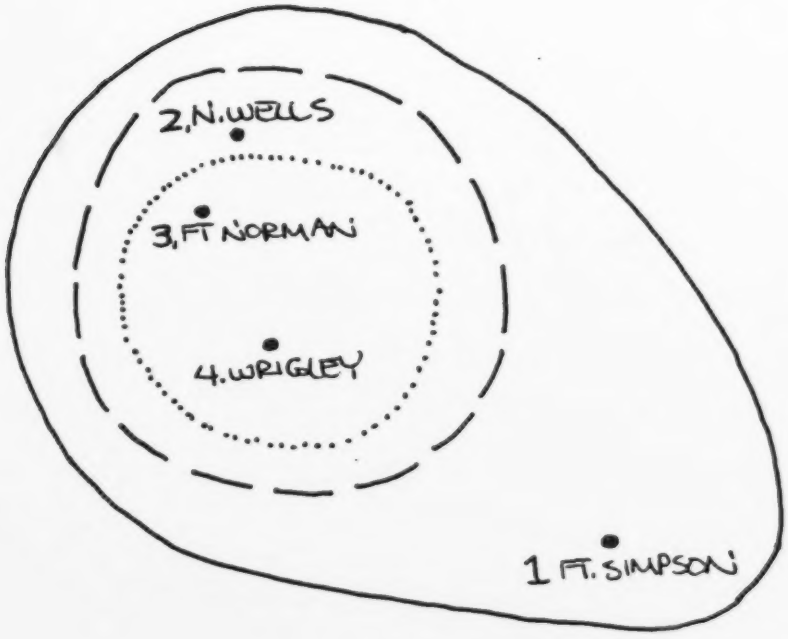
The functional indices of the centres in a properly identified central plant system are regarded as values on a linear scale of centrality (Marshall, J.U., 1969). The centrality difference between any two centres is calculated by simple subtraction.

It is evident from the results of the calculations that the four communities have distinctly different indexes of centrality ranging from 2790 in Fort Simpson to 310 in Wrigley. Assuming that the region was delineated correctly this indicates that there is a hierarchy of central places within the central Mackenzie Valley region.

Implicit in the notion of a functional index is the hierarchical dominance of the central places. The hierarchy among the central places within the central Mackenzie Valley region as indicated by the relative functional indices is illustrated schematically in Figure 1. Fort Simpson is clearly established as the regional centre. Norman Wells is the next lower order having within its sphere of influence Fort Norman and Wrigley. The lowest order centre is Fort Norman which dominates Wrigley.

Figure 1

Functional Index Hierarchy



1 Highest Order Centre _____ Sphere of Influence

2 Next Highest Centre __ __ __ Sphere of Influence

3 Lowest Order Centre ..... Sphere of Influence

4. FUNCTIONAL LINKAGES

After having established the functional hierarchy of the study communities the functional linkage or spatial relationships will be explored to more clearly define the economic relationships among the centres. This is achieved through the utilization of information provided in the results of the survey. One question on the business survey which is used to establish functional linkages is the question "How much service does your firm provide to each of the other centres in the region"? There is also one question in the household survey which relates to shopping patterns, which also provides an indication of spatial relationships.

5. SERVICE LINKAGES

The question from the business survey provides more detailed information as it deals with all of the settlement in the central Mackenzie Valley, not just the four study communities. The results of this question are presented in Tables 6 through 9. The information contained within these tables indicates how many of the firms in the particular community provide no service to all other communities in the region and what percentage of the total number of firms this represents. Secondly, it indicates how many firms in the particular community do provide service to all other communities in the region, what percentage of the total number of firms this represents, and finally, of the firms that do provide service what percentage of their business does this represent. There is also indication given as to the percentage of firms which provide local service only.

With reference to Tables 6 through 9 it is clear that Fort Simpson provides goods and services to all centres within the region. This confirms its position as a regional centre. Norman Wells is the next highest order centre providing service to Fort Good Hope, Fort Franklin, Fort Norman and Wrigley. It is interesting to note that the strength of the linkage or relationship between Norman Wells and the aforementioned communities is stronger than between Fort Simpson and all other communities in the region. The centres which are functionally linked to both Norman Wells and Fort Simpson have a weaker link to Simpson as opposed to those which are only linked to Fort Simpson. In this respect

Table 6

Services Provided from Fort Simpson

	No Service	%	Service To	%	Service Average %
Fort Franklin	206	96	1	.9	1
Fort Good Hope	106	96	1	.9	2
Fort Liard	88	80	19	17	9
Fort Norman	102	102	5	4	6
Fort Simpson	0	0	110	100	86
Inuvik	105	96	2	1.8	1
Jean Marie River	84	76	23	21	5
Nahanni Butte	87	79	20	18	6
Norman Wells	97	88	10	9	2
Trout Lake	86	78	21	19	7
Wrigley	75	68	32	29	7
Yellowknife	101	92	6	5	23
Other Northern	92	84	15	14	20

66 or 60% provided local service only

Table 7

Services Provided from Norman Wells

	No Service	%	Service To	%	Service Average %
Fort Franklin	73	82	14	16	13
Fort Good Hope	74	83	13	15	11
Fort Liard	--	--	--	--	--
Fort Norman	67	75	20	23	16
Fort Simpson	--	--	--	--	--
Inuvik	82	92	5	6	13
Jean Marie River	--	--	--	--	--
Nahanni Butte	--	--	--	--	--
Norman Wells	0		89	100	97
Trout Lake	--	--	--	--	--
Wrigley	86	97	1	1.1	1
Yellowknife	84	95	3	3.3	14
Other Northern	74	83	13	14	58

56 or 63% provided local service only

Table 8

Services Provided from Wrigley

	No Service	%	Service To	%	Service Average %
Fort Franklin	--	--	--	--	--
Fort Good Hope	--	--	--	--	--
Fort Liard	--	--	--	--	--
Fort Norman	--	--	--	--	--
Fort Simpson	--	--	--	--	--
Inuvik	--	--	--	--	--
Jean Marie River	--	--	--	--	--
Nahanni Butte	--	--	--	--	--
Norman Wells	--	--	--	--	--
Trout Lake	--	--	--	--	--
Wrigley	0	0	10	100	100
Yellowknife	--	--	--	--	--
Other Northern	--	--	--	--	--

Table 9

Services Provided from Fort Norman

	No Service	%	Service To	%	Service Average %
Fort Franklin	29	94	1	3.2	3
Fort Good Hope	--	--	--	--	--
Fort Liard	--	--	--	--	--
Fort Norman	0	0	30	97	99
Fort Simpson	--	--	--	--	--
Inuvik	--	--	--	--	--
Jean Marie River	--	--	--	--	--
Nahanni Butte	--	--	--	--	--
Norman Wells	27	87	3	10	7
Trout Lake	--	--	--	--	--
Wrigley	29	94	1	3.2	2
Yellowknife	--	--	--	--	--
Other Northern	--	--	--	--	--

27 or 87% provided local service only

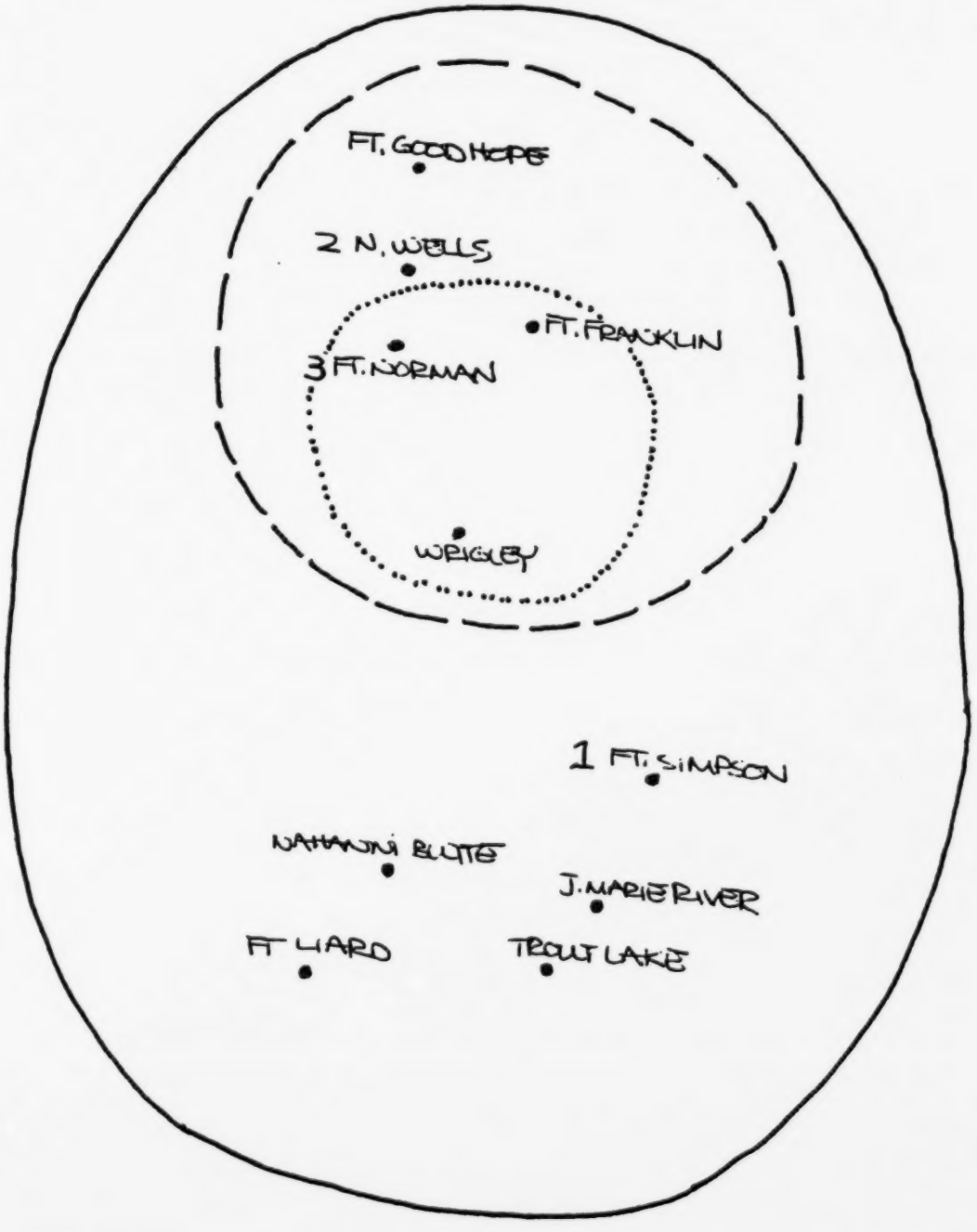
Fort Simpson and Norman Wells compete for certain functions and the distance decay factor determines which one dominates. This distance decay function is much stronger because of the relative isolation of the centres we are dealing with and the prohibitive cost of transportation. This phenomenon is confirmed by the observation of the percentage of firms which provide local service only. This ranges from 100% in Wrigley to 60% in Fort Simpson.

Fort Norman is functionally linked to Fort Franklin, Wrigley and Norman Wells. The amount of service provided to Norman Wells is much smaller than that provided to Fort Norman from Norman Wells. Wrigley does not provide any services to any other community in the region.

Basically, when dealing with service provided by one community to another, functional linkages are established as well as a hierarchy among the various centres. Figure 2 presents a schematic of the hierarchy of central places according to the functional linkages and dominance pattern indicated by the services provided from one community to another. It is interesting to compare Figures 1 and 2 for they capture the same hierarchy. The flow of goods and services therefore confirms the results of the functional index calculations.

Figure 2

Service Linkages Hierarchy



1 Highest Order Centre
2 Next Highest Centre
3 Lowest Order Centre

_____ Sphere of Influence
_ _ _ _ Sphere of Influence
..... Sphere of Influence

6. SHOPPING EXPENDITURE PATTERN

The next method of delineating spatial relationships within the system uses information on shopping patterns generated from the survey. The specific question asked respondents to indicate what percentage of their total shopping expenditure were made in communities within the region, communities in the north and selected cities in the south. This enabled analysis not only of the spatial relationships within the region but also the identification of higher order centres outside the central Mackenzie Valley region.

Table 10 presents the results of the shopping expenditure question. The table indicates the percentage of the population from a particular community that spent money in other communities and the amount these people spent as a percentage of their total shopping bill. The figure of 10% of the population was used as a cutoff value in order to simplify the analysis. Anything less than 10% does not contribute in a significant way to the overall spatial relationships.

Fort Simpson has strong ties with Hay River, Edmonton, Regina and Yellowknife. These centres provide higher order goods and services. This tends to indicate that there is a limited range of goods and services available in Fort Simpson and more generally in the Northwest Territories.

Norman Wells residents spend an inordinate amount of money outside Norman Wells and indeed outside the Territories. Again that is an indication of the limited range of goods available in Norman Wells and

Table 10

Shopping Expenditure Patterns

	% of Population	Spent on Average %	In
Fort Simpson	55	14	Hay River
	52	17	Edmonton
	45	12	Regina
	37	8	Yellowknife
Norman Wells	81	42	Edmonton
	73	22	Yellowknife
	25	27	Hay River
	21	7	Inuvik
	16	6	Fort Norman
Fort Norman	60	13	Norman Wells
	27	8	Yellowknife
	19	6	Inuvik
	10	16	Edmonton
Wrigley	86	13	Fort Simpson
	43	9	Fort Norman
	33	7	Yellowknife

the Northwest Territories on the whole. The residents of Fort Norman spend a greater proportion within the region and within the Territories. Wrigley is on the other extreme from Fort Simpson as a large percentage of respondents spent their money within the central Mackenzie Valley region.

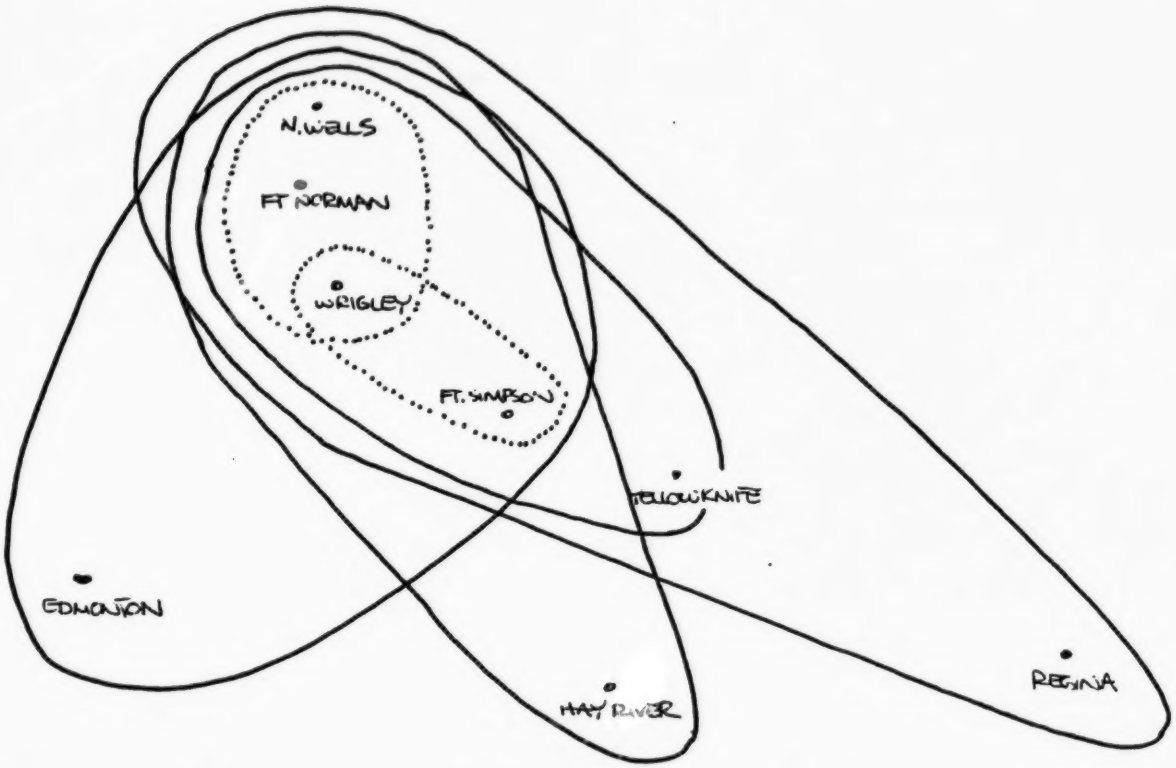
The fact that a higher percentage of respondents from Fort Simpson and Norman Wells spent money outside the region reflects their ability to overcome the friction of distance which is a function of income.

It is clear from the shopping expenditure pattern that many respondents pay a high percentage of their total shopping bill outside the region. This is a reflection of the limited range of goods and services which are available within the region. The goods bought outside the region are of higher order than can be provided within the region and are therefore very expensive. This is an indication of the tremendous leakage from the central Mackenzie Valley region and more typically from communities in the north.

Figure 3 is a schematic representation of the hierarchy of central places within the study region based on shopping expenditure patterns. This figure also provides some indication of higher order centres outside the immediate study region. Within reference to Figure 2 it is clear that Norman Wells is dominant to Fort Norman and Wrigley with respect to shopping expenditures. In other words, respondents from Wrigley and Fort Norman visit Norman Wells in order to purchase higher order goods which are not available in their own communities. Fort Simpson, however, is only patronized in a significant manner by respondents from Wrigley.

Figure 3

Shopping Expenditure Hierarchy



Highest Order Outside Region _____ Sphere of Influence

Dominant Order Within Region ..... Sphere of Influence

It is assumed that the reason for this is related to the fact that the air fare cost differential between Norman Wells and Fort Simpson and between Norman Wells and Yellowknife and Hay River are not great. In such a situation an individual consumer would choose to go to the latter destinations as they offer a wide range of goods. It is also due partially to a function of their isolation.

7. CONCLUSION

It is evident that strategic location with respect to river transportation was the determinant of the economic base of communities in the central Mackenzie Valley. With the exception of Norman Wells all of the communities served as trading posts in the Eighteenth Century. The administration function was superimposed over this existing pattern during the period 1950-60.

With respect to the functionality of the study communities, Fort Simpson, Norman Wells and Fort Norman all provide services to other settlements in the region. A definite hierarchy of economic centres is indicated by the functional indices of the study communities. The hierarchy as established through the functional index calculations and confirmed by the service linkages is, from highest to lowest Fort Simpson, Norman Wells, Fort Norman and Wrigley.

Transportation is a critical limiting factor in the development of an economic system. This is clearly illustrated in this study for the centres are relatively isolated and a good majority of the businesses in each of the centres provide local service only. If transportation linkages were established, the centres would be able to more effectively tap the markets within the region. The main limiting factor, however, is the lack of market or low population in the region.

The shopping expenditure pattern indicates the degree of isolation of the centres and reinforces the fact that there is a limited range of goods offered within the region. It also indicates that a significant amount of money is spent outside the region.

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Copies of these reports can be obtained by contacting Norman Wells Project, Department of Indian Affairs and Northern Development, Les Terrasses de la Chaudiére, Ottawa, K1A 0H4.